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The geometry of two-step nilmanifolds is well understood; Eberlein investigated nonsingular two-step nilmanifolds, describing their curvatures, geodesics, totally geodesic submanifolds and more. In contrast, there has been little work exploring the geometry of higher-step nilpotent Lie groups. We consider the class of *filiform* nilpotent Lie groups. Like 2-step nilpotent Lie groups, filiform groups are “almost abelian,” but in the opposite sense. An n -dimensional filiform Lie algebra is $(n - 1)$ -step.

We study the geometry of filiform nilpotent Lie groups endowed with left-invariant metrics. We describe the connection and curvatures, and we investigate necessary and sufficient conditions for Lie subgroups to be totally geodesic submanifolds. (Received August 21, 2007)